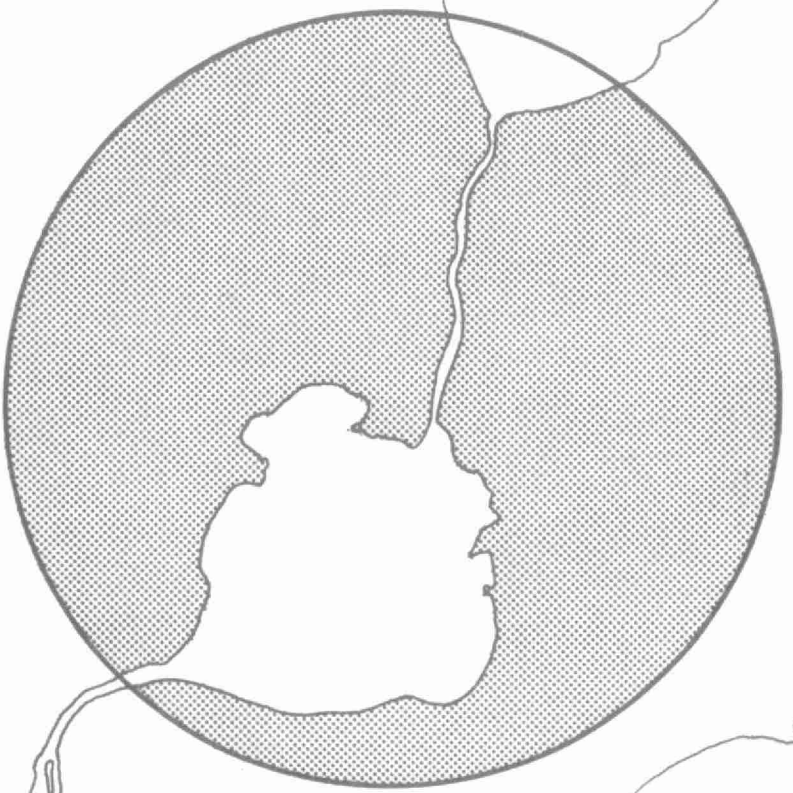
Clear Lake

ontario water resources commission



summary
report on the

1970

mercury pollution
of the
st. clair river system

ONTARIO WATER RESOURCES COMMISSION

SUMMARY REPORT

ON

THE MERCURY POLLUTION OF

THE ST. CLAIR RIVER SYSTEM

June, 1970

TABLE OF CONTENTS

INTRODUCTION

The potential environmental effects of mercury losses to the St. Clair River system from the Dow Chemical Canada Limited (Dow) complex in Sarnia were first brought to the attention of the Ontario Water Resources Commission early in 1969. The discovery of high mercury levels in fish in the St. Clair River and Lake St. Clair precipitated the closure in April 1970 of these waters to sport and commercial fishing. The extent of damages from the mercury pollution has been so severe that the government has found it necessary to make available to commercial fishermen and tourist camp operators interest free demand notes to assist in offsetting their loss of revenue. In May, 1970 the province lifted the ban on sport fishing in the St. Clair system.

This report summarizes the sources, nature and known effects of mercury losses to the St. Clair River and the remedial action taken to date; outlines the conclusions to be drawn from present investigations; and recommends a future course of action to reduce the existing mercury pollution. Emphasis is given to the practicability of removing mercury-laden sediments from the St. Clair River.

1. CONCLUSIONS AND RECOMMENDATIONS

Conclusions

1. Mercury pollution has caused severe damage to the commercial and sport fisheries and associated industries of the St. Clair River - Lake St. Clair system. The effects of pollution of the river sediments are expected to continue to influence the down stream waters for many years.

2. The damage has been sufficiently great that the Ontario government has seen fit to make available interest free demand loans to commercial fishermen and tourist resort operators.

3. To lessen the potential for the continued pollution of the Lower St. Clair River and Lake St. Clair by the mercury presently confined to the twelve mile section of the river below Dow, it would seem to be prudent to remove, by dredging, the polluted sediments from this reach of the river to the greatest extent possible. Dredging should be undertaken providing that the activity associated with dredging does not add to the problem.

4. An experimental dredging program should be undertaken on the St. Clair River to prove the practicability of dredging below Dow.

Recommendation

The OWRC with the assistance of the Canada Department of Public Works should undertake a trial dredging experiment of a specified section of the St. Clair River at the expense of the Dow Chemical Company.

2.1 HISTORY OF MERCURY CONTAMINATION

Mercury poisoning of humans caused by contaminated sea-foods occurred in Japan at Minamata Bay (1953 to 1960) and at Niigata (1965). In Sweden, fish and birds have suffered poisoning from the loss of mercury to the environment. Alberta banned pheasant and Hungarian partridge hunting in 1969 because of high mercury residuals in the birds. Fishing in the Lake Huron - St. Clair River - Lake St. Clair - Detroit River - Lake Erie system has been restricted because of mercury residuals in fish.

2.2 MERCURY AS A POLLUTANT

Mercury finds its way into the water in the form of metallic, inorganic divalent and phenyl mercury. Regardless of the form in which it enters the water, the biota can convert it to its most toxic form, methyl mercury. Ingestion of methyl mercury can produce mercury poisoning.

2.3 SOURCES OF MERCURY

The source of mercury in the St. Clair River is the Dow chlor-alkali complex at Sarnia. Sources other than Dow may include runoff from farms, golf courses and residential properties, effluents from sewage treatment plants and fall-out from fossil fueled generating stations and foundries. Maintenance dredging can distribute mercury

if spoil disposal is not carried out properly.

2.4 MERCURY LOSSES FROM THE DOW CHLOR-ALKALI PLANT AT SARNIA PRIOR TO APRIL 1970

The company has estimated that losses from the chlor-alkali plants averaged 30 pounds per day since production commenced in 1949. In 1969, losses averaged 75 pounds per day, ranging from 47 to 195 pounds per day. The principal losses were in the effluent to the St. Clair River, but other losses occurred from the brine sludge disposal area near Talford Creek, a tributary of the St. Clair River.

2.5 REMEDIAL ACTION TAKEN AT THE DOW CHLOR-ALKALI PLANTS

On March 26, 1970, Dow received a Commission Order requiring that they cease discharging mercury to the St. Clair River. The company has provided the necessary treatment facilities to comply with this Order. The loss of mercury from the chlor-alkali complex is now less than one pound per day.

2.6 EFFECT OF MERCURY

(1) Concentration in Fish

High concentrations of mercury have been found in fish of various species in the St. Clair River system. Levels as high as 7 ppm have been found.

(2) Concentrations in Water

Mercury concentrations in all water samples taken except in the immediate vicinity of the company outfall were less than the detectable level of 0.005 mg/l. Samples immediately downstream of the outfall contained 0.04 mg/l of mercury.

(3) Distribution in Sediments

Mercury concentration in sediments as high as 1,700 mg/l were found immediately below the outfall. Concentrations reduced to 50 ppm 1 1/2 miles downstream, and to 20 ppm ten miles further downstream. The areas with contaminated sediments are within 150 to 300 feet of the Canadian shore. This area is shown on Figure 1 as the "high mercury level zone". The mercury concentrations in Lake St. Clair are generally less than 1 ppm showing gradation from the river inlet with pockets of mercury in the St. Clair River Delta and Mitchell Bay areas at levels of 12 and 8 ppm respectively. Some mercury has accumulated in the shipping channel in U. S. waters immediately below the St. Clair Cut-off Channel (a by-pass channel in the river delta area). It should be noted that the U. S. Corps of Engineers has requested advice from FWQA on disposal procedures for their channel maintenance dredging program this summer.

Concentrations of mercury in the sediments at the head of the Detroit River and in the outflow area of Lake St. Clair are in the

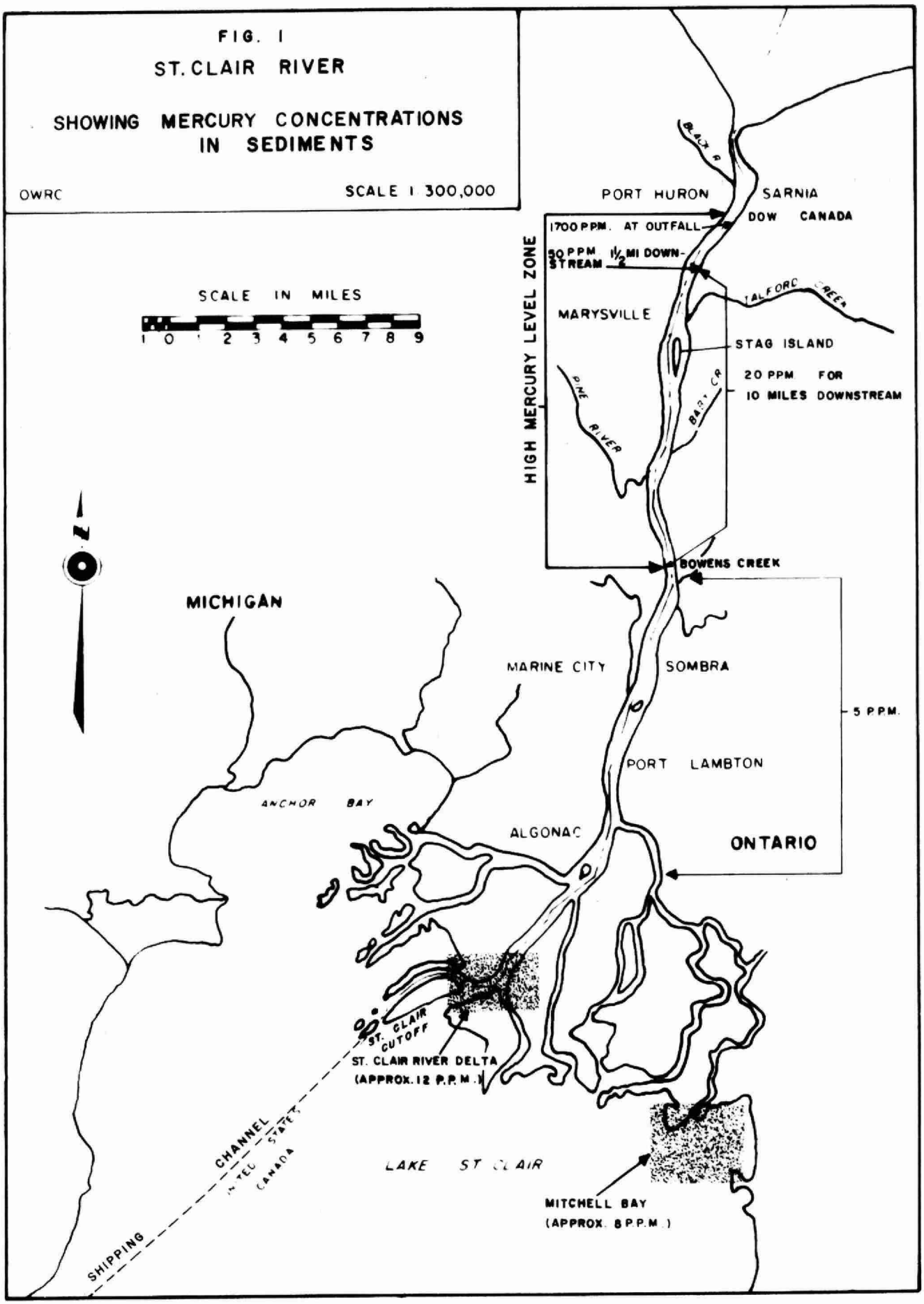


FIG. 1
ST. CLAIR RIVER
SHOWING MERCURY CONCENTRATIONS IN SEDIMENTS
OWRC
SCALE 1 300,000
SCALE IN MILES
1 0 1 2 3 4 5 6 7 8 9
PORT HURON
SARNIA
DOW CANADA
1700 PPM. AT OUTFALL
50 PPM 1½ MI DOWN-STREAM
HIGH MERCURY LEVEL ZONE
MARYSVILLE
STAG ISLAND
20 PPM FOR 10 MILES DOWNSTREAM
PINE RIVER
BOWENS CREEK
MICHIGAN
MARINE CITY
SOMBRA
5 PPM.
PORT LAMBTON
ANCHOR BAY
ALGONAC
ONTARIO
ST. CLAIR CUTOFF
ST. CLAIR RIVER DELTA
(APPROX. 12 P.P.M.)
CHANNEL
SHIPPING
LAKE ST CLAIR
MITCHELL BAY
(APPROX. 8 P.P.M.)

order of 1 ppm.

Calculations based upon Dow's estimate of their mercury losses and the OWRC's estimate of the mercury distribution in the river sediments indicate that 20% of the total mercury losses from Dow which amount to 200,000 pounds are deposited in the bottom sediments in the 12 mile reach of the river immediately below the Dow plants.

2.7 STATUS OF COMMERCIAL AND SPORT FISHERY

(1) Restrictions

In April 1970, sport and commercial fisheries were closed in Lake St. Clair, the St. Clair River and the Detroit River. In May, partial restrictions were placed on commercial fishing in Lake Huron and Lake Erie. Since the initial closure sport fishing has been reopened in Ontario with warnings against the consumption of fish taken.

(2) Loans

The federal and provincial governments have provided interest free demand loans to commercial fishermen who can prove that they have suffered damages due to mercury pollution. As of June 4, $100,545 had been advanced, 50% coming from each government.

At this time, no loans have been made to bait dealers, but if necessary, a formula will be established for the granting of loans.

Ontario established a formula for granting loans to tourist camp operators, who have suffered damages, but the federal government refused to participate in the scheme. Subsequently, Ontario proceeded without the federal government and granted loans to the camp operators.

2.8 FUTURE COURSE OF ACTION AND ALTERNATIVES

(1) Take No Action

Mercury levels in most of the Lake St. Clair sediments are at such low concentrations that control over their effects is practically out of the question. Concentrating remedial efforts on the sections of the river in which mercury concentrations in sediments are the highest would, in the long term, probably hasten the overall recovery of the drainage system. Taking no action to reduce the effects of the mercury accumulations in the sediments of the St. Clair River system would prolong contamination of the sediments and fish and result in retardation of the overall recovery of the system.

(2) Chemical Conversion of the Mercury

While the chemical conversion of mercury to an insoluble sulphide form is feasible in a closed system, it is not feasible in a flowing river such as the St. Clair. The technical problems involved in having any chemical compound come into intimate contact with the mercury over such a large area are both formidable and impractical.

(3) Cover the Mercury-Laden Sediment

The conditions existing in the St. Clair River preclude the feasibility of utilizing a membrane or cover that could adequately contain the mercury contaminated sediments. Any cover would have to be scour resistant, impermeable and strong enough to resist physical damage by boats, anchors and ice.

(4) Remove Mercury Contaminated Sediments

Suction dredging is the most suitable alternative available at this time. Even so, it must be recognized that it is not possible to dredge all mercury-laden sediments from the system. However, dredging in the areas of greatest mercury concentration would accelerate the rate of recovery of the downstream river and lake areas.

It is estimated that the removal of all contaminated sediments in the high mercury level zone would require that 480,000 cubic yards of material be dredged at a cost of approximately $1.7 million (based on diked disposal exclusive of land cost).

As shown in Figure 2, the amount of mercury recovered by dredging sediments would decline rapidly as the concentration of mercury in the sediment decreases. This is based on an estimate of the accumulations in the river and is subject to confirmation as more detailed information comes available.

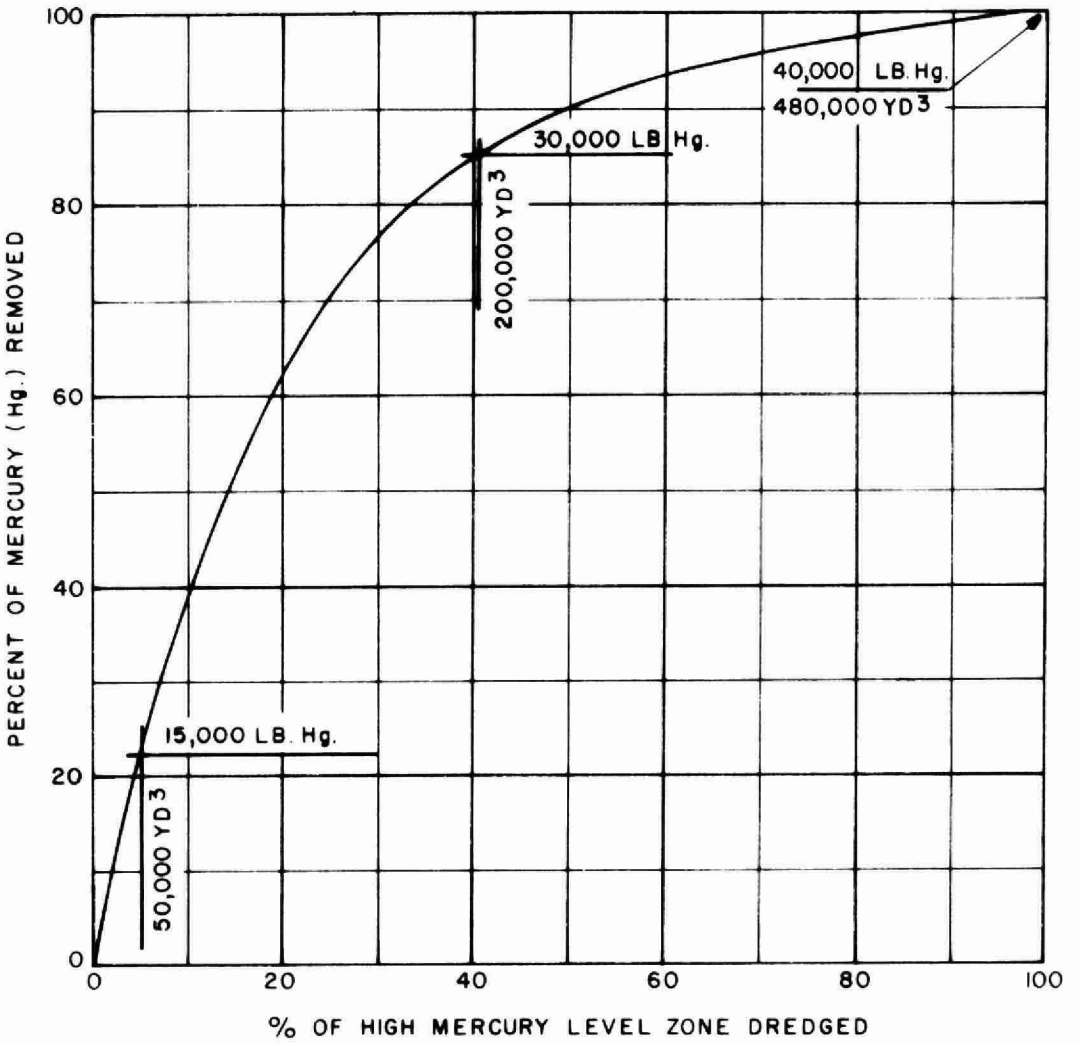


FIGURE 2

QUANTITATIVE RECOVERY OF MERCURY BY DREDGING SEDIMENTS
IN THE ST. CLAIR RIVER
BETWEEN DOW COMPLEX AND BOWENS CREEK

The only area with sufficiently high concentrations of mercury to warrant dredging is the section of the river from Dow to Bowens Creek, a distance of 12 miles where approximately 40,000 pounds of mercury have accumulated in the sediments.

If 50,000 cubic yards of sediments were dredged immediately downstream of the plant about 15,000 pounds of mercury would be recovered. Dredging 200,000 cubic yards would recover 30,000 pounds whereas dredging 480,000 cubic yards would recover a total of 40,000 pounds, (the bulk of mercury in the zone).

The efficiency of mercury removal by dredging and problems with possible redistribution in the water and sediments are unknown. Experimental work is required to determine whether these may be significant factors in causing further pollution of downstream waters and sediments.

A problem which has recently arisen in Hamilton Harbour related to the opening of a slip may provide some of the required information. If the dredging operations currently planned for Hamilton are undertaken, the Commission will monitor the operation to determine the suitability of suction dredging for removing mercury contaminated sediments. Information from this operation could be of value in establishing a dredging proposal for the St. Clair River. An experimental dredging program should be undertaken on the St. Clair River to prove the practicability of dredging below Dow. If dredging appears

to be practicable in the area below Dow, suitable spoil disposal areas must be located for the sediments removed from the St. Clair River. The disposal areas will have to be capable of retaining the mercury deposited with the spoils.